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Please find below and/or attached an Office communication concerning this application or proceeding.

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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Paper No. 14

Application Number: 09/825,612
Filing Date: April 03, 2001
Appellant(s): SHARAN ET AL.

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Sharan et al.
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 8/29/03.

(1) Real Party in Interest

A statement identifying the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

A statement identifying the related appeals and interferences, which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief.

(3) Status of Claims

The statement of the status of the claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Invention

The summary of invention contained in the brief is correct.

(6) Issues

The appellant's statement of the issues in the brief is correct.

(7) Grouping of Claims

The rejection of claims 13-18, 22-26, and 28 stand or fall together because appellant's brief does not include a statement that this grouping of claims does not stand or fall together and reasons in support thereof. See 37 CFR 1.192(c)(7).

(8) Claims Appealed

The copy of the appealed claims contained in the Appendix to the brief is correct.

(9) Prior Art of Record

6,294,466	CHANG	9-2001

Muller and Kamins, "Device Electronics for Integrated Circuits", John Wiley and Sons, pg. 102, © 1986.

(10) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.
> The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

Claims 13-15 are rejected under 35 U.S.C. 102(e) as being anticipated by Chang (6,294,466). In re claim 13, Chang discloses in fig. 1 a method of making a semiconductor device, comprising the steps of: forming a product in a PECVD chamber (36) through an interaction of a chemically inert charged species producer gas (col. 11 lines 31-32, ref. 100d) and a metal-containing compound (col. 11 lines 33-36, ref. 100a) in a plasma (col. 11 lines 42-44) and exposing a substrate (54) to said product.

In re claim 14, Chang discloses wherein said step of forming a product comprises forming a product free of constituents of said chemically inert charged species producer gas (col. 11 lines 51-53).

In re claim 15, Chang discloses wherein said step of exposing a substrate to said product further comprises forming a metal layer free of constituents of said chemically inert charged species producer gas (col. 11 lines 51-53).

In re claim 22, Chang discloses a method of performing a back-end-of-the line process comprising: providing a semiconductive device (54) under fabrication; placing said device in a vacuum chamber (36); supplying a metal source gas (100a) and a chemically inert-excitation gas (100d) within said vacuum chamber; and interacting said metal source gas and said chemically inert gas (col. 11 lines 42-44).

In re claim 23, Chang discloses wherein said step of interacting comprises igniting a plasma (col. 1 lines 64-67).

In re claim 24, Chang discloses a making a semiconductor device using PECVD comprising: providing a semiconductor device (54) under fabrication; placing said device in a vacuum chamber (36); forming combined gases comprising a metal source gas (100a) with a chemically inert energy-transfer gas (100d); supplying said combined gases to said vacuum chamber; and igniting a plasma (col. 1 lines 64-67).

In re claim 25, Chang discloses wherein said step of igniting a plasma comprises interacting said combined gases (col. 1 lines 64-67).

In re claim 26, Chang discloses wherein said step of interacting said combined gases comprises producing a charged species (col. 1 lines 59-67 – col. 2 lines 1-8).

In re claim 28, Chang discloses a semiconductor processing method comprising the following steps: providing a semiconductor wafer (56); subjecting said wafer to PECVD conditions in a chamber (col. 1 lines 57-65); forming an ionized reactant species by interacting a metal source material (100a) with a chemically inert collider gas (100d) in said chamber (col. 2 lines 1-8); and forming a metal-containing layer on said wafer from said ionized reactant species (col. 14 lines 28-43).

Claims 16-18 are rejected under 35 U.S.C. 102(e) as being anticipated by Chang in view of Muller and Kamins, "Device Electronics for Integrated Circuits", John Wiley and Sons, pg. 102.

In re claims 16 & 17, Chang discloses wherein said step of forming a product further comprises forming a metal-containing ion of said metal-containing compound (col. 11 lines 51-53, col. 2 lines 1-8). The method of Chang interacts a chemically inert charged species producer gas and a metal-containing compound in a plasma, which is <u>inherently</u> forming a metal-containing ion and metal-free ion from said metal-containing compound (see Muller and Kamins, pg. 102).

In re claim 18, Chang discloses further comprising a step of introducing a reactant gas (col. 6 lines 27-28) to said metal-containing ion; and wherein said step of exposing a substrate to said product comprises exposing said substrate to said product and said reactant gas (col. 11 lines 29-40, col. 1 lines 57-65).

(11) Response to Argument

On pg. 3 of the applicant's arguments, applicant's representative argues that Chang does not express Argon's specific role as a charged species producer, an

excitation gas, an energy-transfer gas, or a collider gas. Arguments are not found persuasive. First, Chang discloses the same mechanism of the claimed invention of depositing a product, Titanium, in a PECVD chamber through an interaction of a chemically inert charged species producer gas, Argon, and a metal-containing compound in a plasma, TiCl4, onto a substrate. Chang's method must operate in the same manner as the instant claims because Chang uses the same reactants and same method as the instant claims to form an identical product. Second, Chang does not have to expressly claim Argon to be a charged species producer, an excitation gas, an energy-transfer gas, or a collider gas because Argon has the same function as the claimed limitations as disclosed by Chang. The formation of Titanium from Argon and Titanium chloride ("TiCl4") is inherently the same process as the instant claims because Chang teaches Argon which interacts with TiCl4 to form Titanium. There is nothing to suggest in either the application or in Chang that another product would result from this mechanism. See MPEP 2163.07(a). By disclosing a patent application a device that inherently performs a function or has a property, operates according to a theory or has an advantage, a patent application necessarily discloses that function, theory, or advantage, even though it says nothing explicit concerning it. *In re Reynolds*, 443 F.2d 384, 170 USPQ 94 (CCPA 1971); *In re Smythe*, 480 F.2d 1376, 178 USPQ 279 (CCPA 1973). Third, the instant specification in ¶12 discloses that a noble gas or an inert gas is added to encourage the reaction, be chemically active, or react with other gases. In ¶27, the applicants disclose that the reaction is TiCl4, Hydrogen, and an inert reaction promoter gas. ¶37 says that Argon is the preferred reaction-promoter gas. Therefore,

Argon as taught by Chang is the charged species producer, an excitation gas, an energy-transfer gas, or a collider gas in the reaction.

At the bottom of pg. 3, the applicant's representative argues that Chang does not teach igniting a plasma, but teaches the opposite of igniting a plasma. Applicant contends that Chang teaches that the RF energy forms the plasma, not igniting a plasma. Applicant's point is moot because the limitation that the RF energy forms the plasma is not found in the claims. Chang specifically refers to "'igniting' the plasma" in col. 1, lines 64-66. Applicant's claimed invention in claim 23 and 24 has the limitation of: "igniting a plasma." Chang further discloses the effect of "igniting the plasma" which is well known in the art in the passage in col. 1, line 57 – col. 2, line 8. Chang does not teach away from "igniting the plasma."

Regarding applicant's argument that Chang fails to distinguish Argon from reactive process gases is not persuasive for the following reasons. First, Chang discloses that Argon is a process gas (col. 11 lines 31-32; ref. 100d) that interacts with a metal-containing compound (col. 11, lines 33-36; ref. 100a) in a plasma (col. 11, lines 42-44). Second, an inert gas may be a reactive process gas. Because noble gases, such as Argon, have filled s and p valence orbitals, they were not expected to be chemically reactive. For many years, these elements were called inert gases because of this supposed inability to form any compounds. However, in the 1960s several compounds of inert gases were synthesized. An inert gas thus may be a reactive process gas. Third, Argon is employed in combination with the metal-containing compound, TiCl4, to form a product or a metal-containing layer, Titanium, on the wafer.

Argon is used to remove or displace Chlorine from the TiCl4 in order to deposit pure Titanium (col. 11, lines 50-53). Fourth, Argon is included in the plasma forming gas (col. 11, lines 30-33; fig. 5, ref. 212). The plasma forming gas that Argon is a part of is essential to depositing the Titanium film. Once the metal-containing compound TiCl4 is flowed in the reactive process gas Argon that is now a plasma, the product or a metal-containing layer Titanium can be deposited on the wafer (fig. 5; col. 11, lines 33-53).

Applicant's representative argues that Chang fails to label Argon as a charged species producer, an excitation gas, an energy-transfer gas, or a collider gas. Applicant's point is not found persuasive for the following reasons. First, as discussed before, Chang discloses the same mechanism as the instant claims. Chang's method must operate in the same manner as the instant claims because Chang uses the same reactants and same method as the instant claims to form an identical product (col. 11, lines 25-53). Second, Chang does not have to expressly claim Argon to be a charged species producer, an excitation gas, an energy-transfer gas, or a collider gas because Argon has the same function as the claimed limitations as disclosed by Chang. The applicant is merely labeling the process gas. The instant specification does not give any special meaning to the terms (see ¶14, 28-31, 42). In ¶29, the instant specification refers to TiCl4, H2, and <u>the reaction promoter gas</u>. ¶30 refers to Argon as being the <u>"reaction promoter gas"</u>. Therefore, if Chang discloses Argon as the process gas, he is inherently disclosing Argon to be: a charged species producer, an excitation gas, an energy-transfer gas, or a collider gas. One skilled in the art would recognize that the formation of Titanium from Argon and Titanium chloride ("TiCl4") is inherently the same

process as the instant claims because Chang teaches Argon which interacts with $TiCl_4$ to form Titanium. There is nothing to suggest in either the application or in Chang that another product would result from this mechanism.

B. Applicants' supplemental arguments

Applicant argues that *Crown Operations Intl.* ("Crown Intl.") is applicable and that if there is inherency in the prior art, the prior art must discuss it. Applicant's point is not persuasive. The fact pattern of the instant case is difference from the fact pattern in Crown Intl. Chang discloses the claimed method and the properties of Argon are inherent to this process. The applicant's argument is based on language that labels Argon as a: a charged species producer, an excitation gas, an energy-transfer gas, or a collider gas. The content of the prior art is identical to the claimed invention. The properties of Argon are inherent to the process.

Applicant argues that Chang in view of Muller does not teach the claim 17 limitation of forming a product comprises forming a metal-free ion from the metal-containing compound. This point is not persuasive because Chang teaches activating $TiCl_4$ and depositing Titanium. Muller teaches that PECVD (plasma enhanced chemical vapor deposition) is in a chamber (i.e.: closed), and produces a gas mixture and a deposited film. The activated chlorine is inherently a byproduct of PECVD deposition of $TiCl_4$. The activated chlorine from $TiCl_4$ is the metal-free ion. The PECVD process is in a closed chamber where there is a metal deposited and a metal-free ion remains.

C.

1. Applicant argues that change does not teach the limitation of claim 13 of "chemically inert charged species producer gas." Applicant's point is not found persuasive. Please refer to response to arguments above. First, Chang teaches Argon (col. 11, lines 29-34). Second, the instant specification teaches Argon (¶29-32, 36-37). The instant specification teaches that Argon is the preferred reaction-promoter gas (¶37). Second, Chang teaches the inherent property that Argon is inert (col. 11, line 33). Third, the citation of the use of RF power is illustrated to point out that when Argon and the other gas are formed into plasma in the PECVD chamber, the result is a charged species producer gas (col. 1, lines 56-67). Note from Chang, "It is well known, a plasma, which is a mixture of ions and gas molecules, may be formed by applying energy, such as radio frequency (RF) energy, to a process gas in the deposition chamber." It is well known that ions are charged species. Fourth, Chang discloses that the energized molecules and the ionic ***species*** are typically more ***reactive*** than the process gas and more likely to form the desired film (col. 2, lines 1-4). Fifth, Chang in figure 5 is referring to the process gas, Argon, which is flowed into the process chamber (ref. 210), and forms a plasma in the process chamber (ref. 212). Therefore, Chang teaches that Argon is chemically inert and a charged species producer gas.

Applicants argue that the examiner is not allowed to assert their own understanding or experience in light of the *In re Zurko* decision. Applicant's point is moot because the examiner is relying on prior art and inherent teachings the prior art. The *In re Zurko* decision is not applicable to the facts of this case because each case has its own unique fact pattern. The examiner does not have to point out to some

concrete evidence in the record if the properties are inherent. The applicant has the burden to prove that the examiner's assertion of inherency is incorrect.

2. Applicant argues that Chang fails to disclose neither a chemically inert charged species producer gas nor its interaction with a [sic] compound. Applicant's point is moot. See discussion above. Chang discloses a chemically inert charged species producer gas (100d) and its interaction with a metal-containing compound (100a), (col. 11, lines 33-40).

3. Applicant argues that Chang fails to teach Argon with the properties of: a charged species producer, an excitation gas, an energy-transfer gas, or a collider gas. See discussion above. Applicants point is not persuasive. Applicant states that the examiner makes an "assumption that such terms are interchangeable." This assumption is correct and is supported by the instant specification (¶¶29-31, 42). First, there is **no explicit** teaching in the instant specification that any of the terms are different from one another or hold different advantages. Second, the instant specification discloses that Argon can be used as any term. Third, the terms are labels. Fourth, Chang discloses Argon (col. 11, lines 30-33), which is the charged species producer. Fifth, Chang inherently discloses Argon as a charged species producer, an excitation gas, an energy-transfer gas, or a collider gas because Argon is serving the same function in the mechanism of forming a product. Sixth, the applicant has failed to point out any selection in the specification that teaches away from Argon being a charged species producer, an excitation gas, an energy-transfer gas, or a collider gas.

4. Applicant points out that Chang discloses, "The plasma forming gas may or may not include a flow of an inert carrier gas, such as Argon." Since Chang discloses an embodiment (fig. 1-5) using Argon as the inert charged species producer gas when forming Titanium and the advantages thereof, Chang has met the burden of disclosing the claimed invention (col. 11, lines 13-60). Chang discloses Argon (100d) in figure 1 as part of the deposition process. Applicant's point is thus moot because the prior art clearly includes and illustrates the use of Argon in a preferred embodiment.

5. Applicants argue that Chang does not express Argon as a charged species producer, an excitation gas, an energy-transfer gas, or a collider gas. This point is not persuasive. See arguments above.

6. Applicant argues that Chang's disclosure of RF energy and failure to attribute that property to its Argon, demonstrates that Chang fails to disclose an inert gas having the properties expressed in the appealed claims. Applicant's point is moot for the following reasons. First, Chang discloses Argon as a producer gas (col. 11, lines 30-34). Second, Chang discloses Argon is an inert gas (col. 11, lines 30-34). Third, the applicants have failed to claim the properties of this inert gas. The applicant cannot now introduce properties of the inert gas. Therefore, Chang cannot fail to teach unclaimed limitations of the inert gas. Furthermore, the properties of Argon are inherent in the teaching of Chang.

7. Applicant argues that Chang is ambiguous on his teaching whether Argon is a process gas. Applicant's argument is not found persuasive. See response above. First, Chang teaches a preferred method in fig. 1-5 using Argon in the plasma forming

gas (col. 11, lines 30-34). Second, Chang teaches that the method is a CVD method (col. 11, line 15). This requires that the method disclose a CVD chamber (col. 1, lines 57-65; col. 2, lines 1-8; ref. 38). Third, Chang discloses that in the CVD chamber there is an interaction between the process gas and the metal-containing compound in a plasma (col. 1, line 38 – col. 2, line 8). Fourth, Chang discloses that the *prior art* teaches a reaction of TiCl4 + 2H2 yields Titanium. However, this prior art deposition process is **unfavorable** because there is unwanted metal deposition. Fifth, Chang discloses that the preferred embodiment including Argon will help avoid unwanted deposition with in the chamber (col. 3, lines 1-15; col. 11, lines 30-34).

D. Applicant argues that each of the appealed claims requires an inert gas having a certain property. This point is not persuasive because the claim limitations do not claim certain properties. Applicant admits that Chang discloses Argon. Applicant argues that Chang does not exhibit the claimed properties. This point is not persuasive because the applicant is using a charged species producer, an excitation gas, an energy-transfer gas, or a collider gas as labels and the specification does not support applicant's position that each claim limitation has a certain property. In fact, the specification uses these terms interchangeably (¶¶29-31, 42). In conclusion, Chang discloses a method of making a semiconductor device comprising the steps of: forming a produce in a PECVD chamber (ref. 38) through an interaction of a chemically inert charged species producer gas (col. 11, lines 30-34; ref. 100d) and a metal-containing compound in a plasma (ref. 100a; col. 11, lines 35-37) and exposing a substrate (ref. 54) to said product.

Respectfully submitted,

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December 18, 2003

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